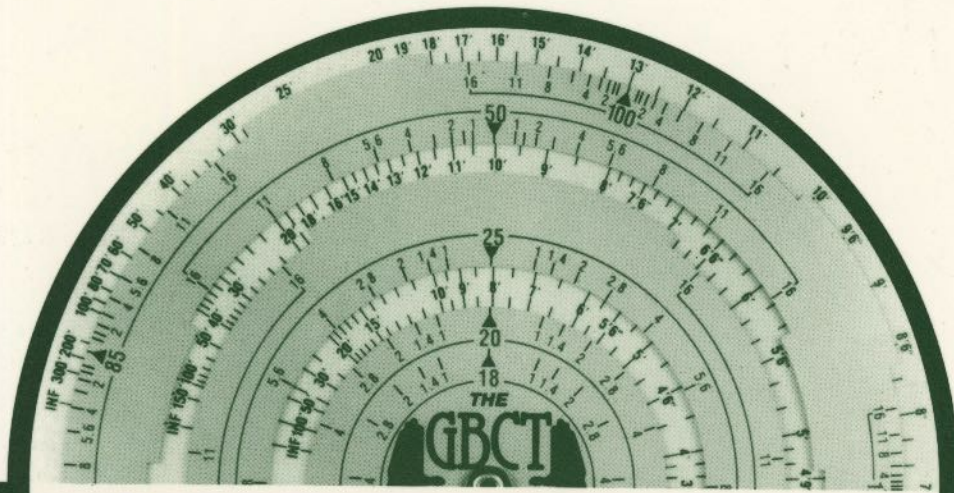


2nd Edition



# GUILD KELLY calculator

© 1982

A fast and easily operated disc calculator for all main cinematographic calculations. Available in 35mm and 16mm imperial or metric versions. Fits neatly in the pocket. For cinematographers, TV camerapersons and all technicians concerned with film or TV production.



# **GUILD KELLY calculator**

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# **INSTRUCTIONS**

Produced by

**The Guild of British Camera Technicians**

**5-11 Taunton Road, Metropolitan Centre,  
Greenford, Middlesex UB6 8UQ.**

in association with  
**Kodak Limited**

# INTRODUCTION

Cinematography has changed a great deal since the original "Kelly Cine Calculator" was designed during the war by W. B. Pollard, FBKS, in conjunction with the cameraman Skeets Kelly and marketed by Kelly in 1955. The range of lenses and their apertures has greatly improved, filmstocks and fields of view have changed and metric dimensions are more generally used. To meet these changes the development and re-design of the Kelly calculator was initiated by the Guild of British Camera Technicians in association with Kodak Limited. The computer program for the formulæ relating to the new lenses, in both 35mm and 16mm, spherical and anmorphic for the new Guild Kelly was drawn up by Dr. Stephen Jackson.

The Guild Kelly is produced in four versions, 35mm imperial and metric, and 16mm imperial and metric. They have a wide selection of lenses and the apertures are marked down to  $f/1$  to keep ahead of lens developments. Improvements in the quality of both lenses and filmstocks have meant that the circle of confusion has also become more critical. This means that the Guild Kelly indicates a reduced depth of field in comparison with the old Kelly. The old Kelly used a circle of confusion of  $1/500$ th of an inch, the Guild Kelly uses a circle of confusion of  $1/707$ th of an inch. [This figure is  $1/500$  multiplied by the square root of 2 which is the common factor between stops 1.4, 2, 2.8, 4, 5.6

and so on.] The circle of confusion is even more critical on the 16mm version with a value of 1/2000th of an inch to allow for the greater degree of magnification involved in the cinema presentation of 16 and super 16 films.

On the back of the calculator the time to film length scales remain the same but the black and white filters have been dropped from the exposure compensator and neutral density and colour filters have been included instead. An ASA/DIN scale has been added. The field of view scales cater for 16mm 1:1.4 ratio, the 35mm Academy 1:1.33, widescreen 1:1.85 and the 35mm anamorphic 1:2.35.

It must be remembered that the calculator is only a guide to depth of field and that there are numerous factors which affect it, from the contrast of the subject to the place the viewer likes to sit in the cinema.

The Guild Kelly calculator has been produced by cameramen for cameramen in film and television and perhaps the most important thing is the fact that, like the original Kelly, it fits into the focus puller's back pocket.

**GUILD OF BRITISH CAMERA TECHNICIANS**  
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# INSTRUCTIONS

## FRONT OF CALCULATOR (MARKED "GBCT GUILD KELLY")

The scales on the front of the Calculator are for working out two properties of a lens, *hyperfocal distance* and *depth of field*.

*The depth of field* is the distance either side of the plane at which the lens is focused that is acceptably sharp.

The *hyperfocal distance* represents a special case of depth of field. A lens set at its hyperfocal distance will give an acceptably sharp image from infinity to an object situated at half the hyperfocal distance. The hyperfocal distance of a given lens varies with its focal length and aperture (F stop) in use.

On the front of the 35mm version of the Calculator there are scales for ten lenses with focal lengths of 18mm, 20mm, 25mm, 32mm, 40mm, 50mm, 75mm, 85mm,

100mm and 135mm.

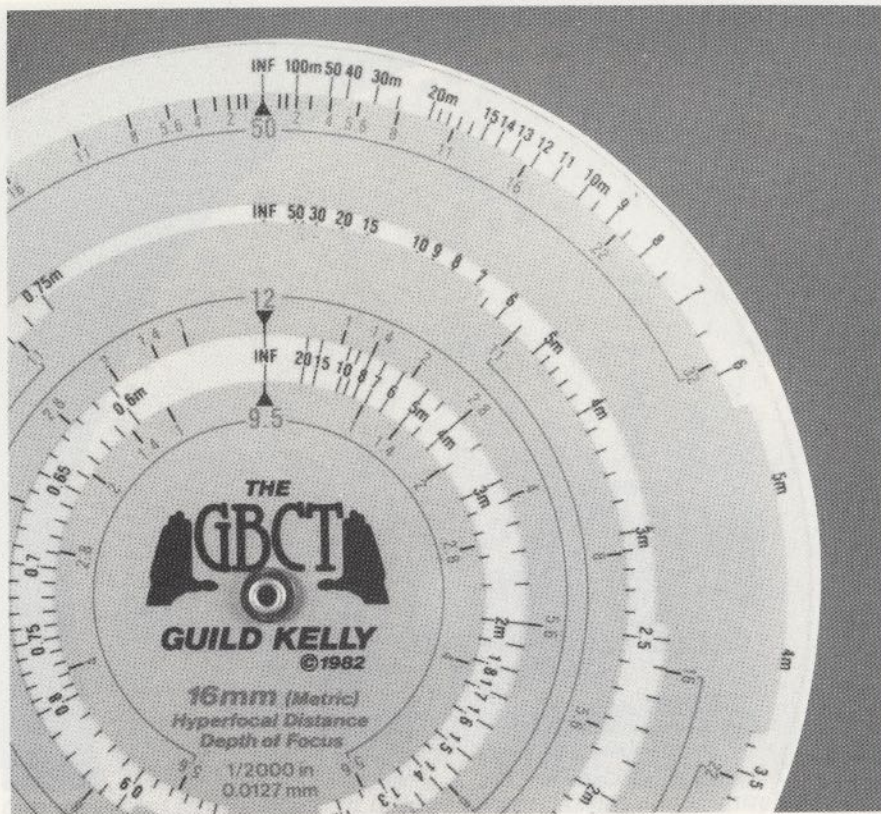
On the 16mm version there are scales for seven lenses with focal lengths of 9.5mm, 12.5mm, 16mm, 25mm, 50mm, 75mm and 100mm.

The focal length of each lens with its range of F stops is marked in red on the top movable scale.

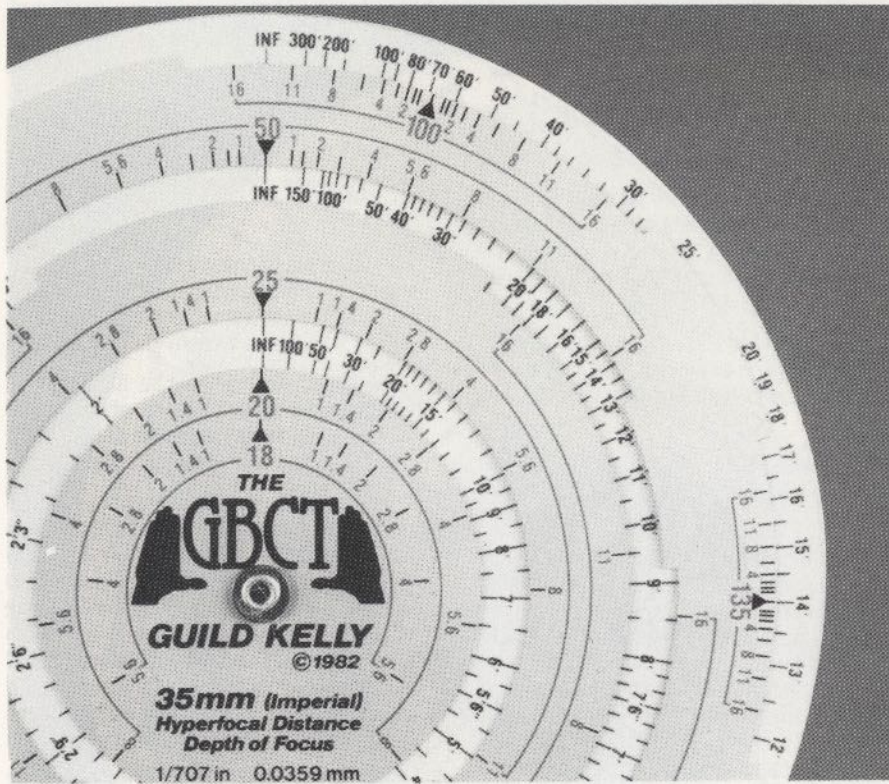
## (1) HYPERFOCAL DISTANCE AND MAXIMUM DEPTH OF FIELD

To obtain the hyperfocal distance for the particular lens being used align the plane of focus mark (the black triangle just above or below the focal length value marked in red) with infinity on the black scale. The hyperfocal distance for each F stop can be read off on the black scale to the *right* of the plane of focus mark.

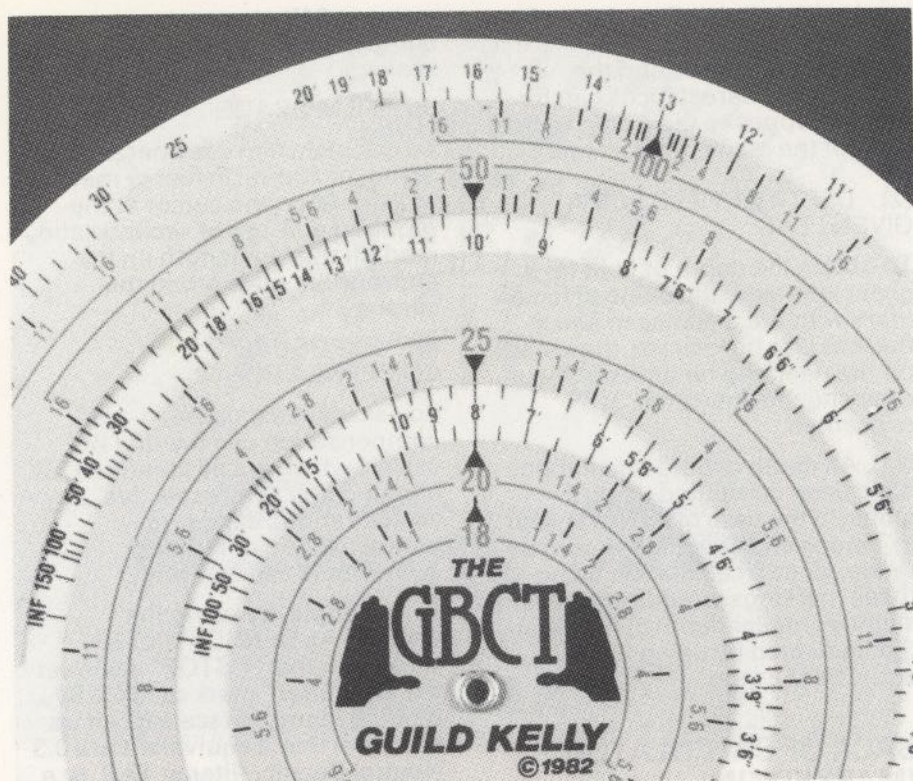
To obtain the maximum depth of field align the F stop to be used, to the *left* of the plane of focus



Calculator set to find hyperfocal distances of 9.5mm, 12mm and 50mm lenses. (Front of calculator, 16mm metric version.)



Calculator set to find hyperfocal distances of 18mm, 20mm, 25mm and 50mm lenses. (Front of calculator, 35mm imperial version.)



*Calculator set to find depth of field of 18mm, 20mm and 25mm lenses focused at a distance of 8' 0", a 50mm lens focused at a distance of 10' 0" and a 100mm lens focused at 13' 0". The depth of field for each lens can be read off directly against the appropriate F stop to be used. (Front of calculator, 35mm imperial version.)*



mark with infinity. The plane of focus mark now gives the hyperfocal distance and the distance of nearest focus can be read off opposite the F stop to the *right* of the plane of focus mark.

#### (2) DEPTH OF FIELD FOR A GIVEN LENS

To obtain the depth of field for a given lens align the plane of focus mark with the distance to which the lens is to be focused, then read off the near and far limits of focus opposite the apertures concerned.

N.B. All depth of field calculations have been computed using F stops. In the case of lenses scaled in T stops an allowance should be made, since a calculation using these markings would result in a slightly smaller depth of field than that indicated by using the equivalent F stop.

#### BACK OF CALCULATOR (MARKED "IN ASSOCIATION WITH KODAK")

On the back of the Calculator are scales for film length to time

ratios at 24fps, exposure compensation and field of view scales.

#### (3) FILM USAGE

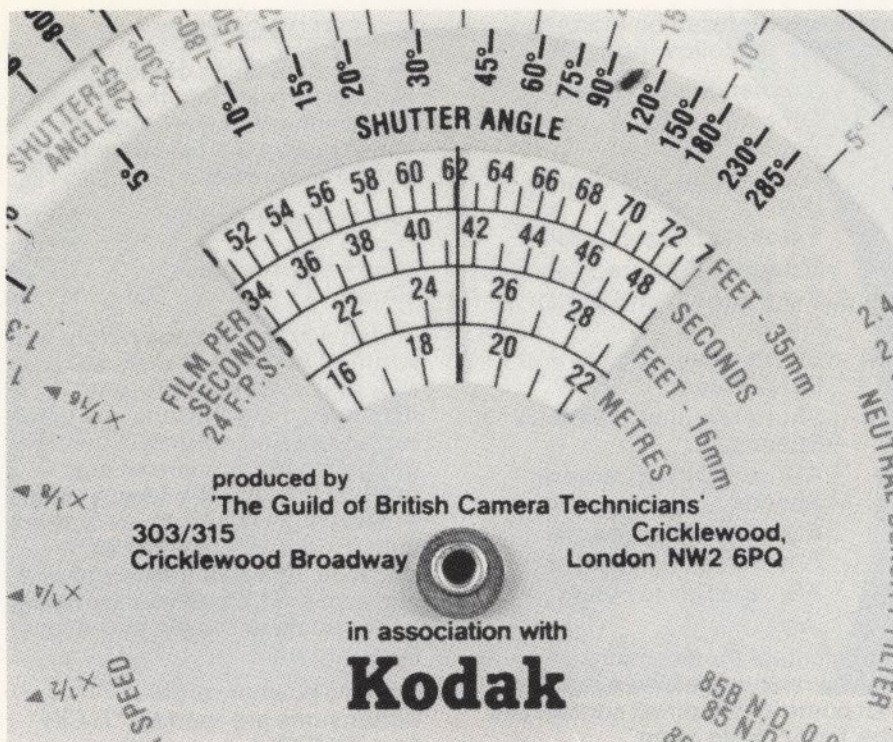
To calculate film used per second, 35mm or 16mm, in feet or metres, at 24fps align the cursor at the required number of seconds and read off the film length on the appropriate scale along the cursor.

#### (4) EXPOSURE COMPENSATION

To calculate exposure compensation use the ring of scales, which are all identified. By aligning any two respective scales various exposure compensation or lighting equivalents can be found.

For example, by using the "NEUTRAL DENSITY FILTER" scale with the "T STOP" scale set the "No Filter" mark at "T4". By reading along the scale it can be seen that this is equivalent to a 0.3 Neutral Density filter at T2.8, or a 0.5 Neutral Density filter at T2.2, or an 85 or 85B colour conversion filter at T3.2 and so on.

By aligning any two particular scales on this ring exposure



Length of shot (seconds) to footage exposed conversion scale. (Back of calculator, all versions.)

compensation can be made to and from the following:

- (A) Footcandles to T stops
- (B) Footcandles to Shutter Angles
- (C) Footcandles to ASA and DIN
- (D) T stops to Shutter Angles
- (E) T stops to Camera Speeds
- (F) T stops to ND and 85 ND Filters
- (G) Shutter Angles to ND and 85 ND Filters
- (H) Shutter Angles to Camera Speeds
- (I) ASA and DIN to Camera Speeds
- (J) ASA and DIN to Shutter Angles
- (K) ASA and DIN to Filters

To calculate the exposure compensation between scales not coming into direct contact use the T stop scale as an intermediary. This enables conversions to be made from and to:

- (L) Footcandles to Filters
- (M) Footcandles to Camera Speeds.

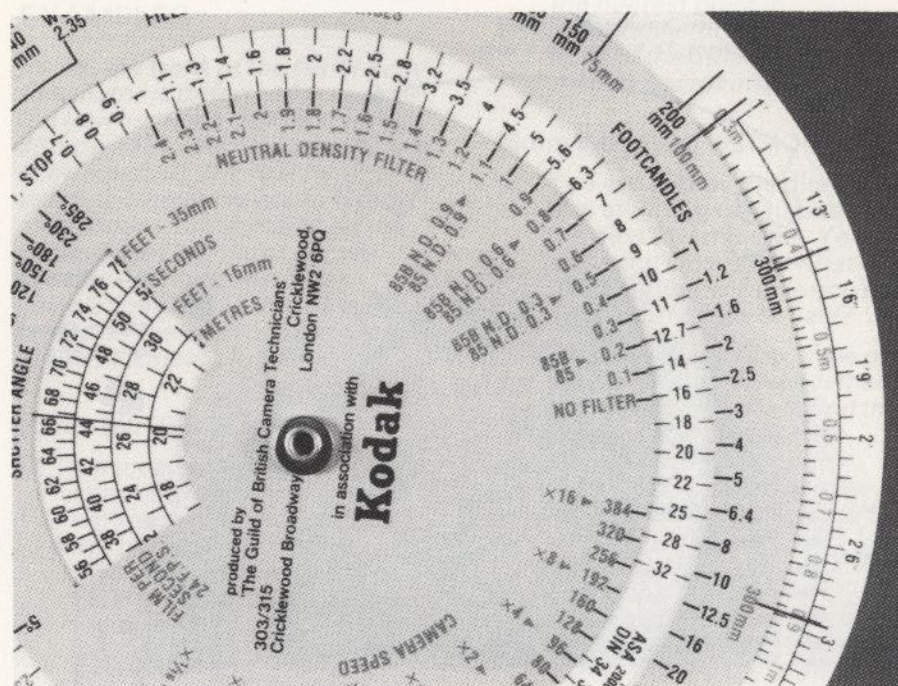
#### (5) FIELDS OF VIEW

To calculate fields of view of various formats use the scales on the periphery of the Calculator. Those scales will calculate for the following formats:

35mm Academy	1:1.37
35mm	1:1.85
35mm anamorphic	1:2.35
16mm	1:1.4

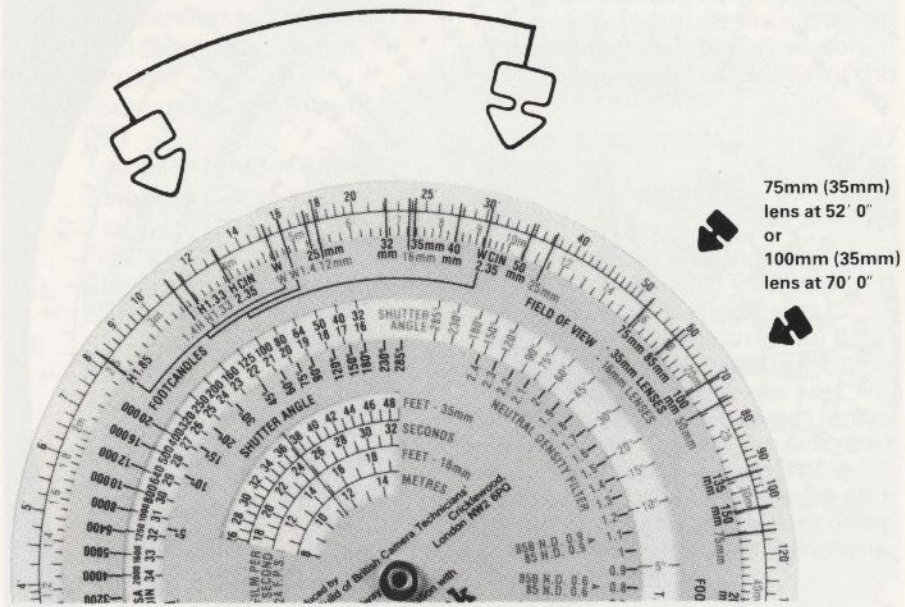
The scales will give the height and width of the field of view using different lenses at different distances. Find the lens you want to use and make sure it is the right gauge (the 35mm lenses are marked in black, the 16mm lenses in red). Align the lens cursor mark with the subject to camera distance. Read off the height and width of the format you are using on the scale to the *left* of the lens cursor mark.

(Note: The anamorphic dimensions are marked "H CIN" and "W CIN").



Neutral density filter scale using in conjunction with T stop scale. Illustration shows "No Filter" set against "T16". The equivalent T stops can be found for any neutral density filter from the range given on the filter scale. For example, the equivalent T stop when using an 85B ND 0.9 filter can be read off as T4.5 opposite this filter value. (Back of calculator, all versions.)

Field of view, anamorphic (1:2.35)  
 Dimensions: 13' 0" high x 30' 6" wide.



Use of field of view scales for different lenses at different distances, and for varying aspect ratios. Example shows use to obtain field of view using 75mm and 100mm (35mm) anamorphic lenses. (Back of calculator, all versions.)

## EXAMPLES

*[Note: the front of the Guild Kelly Calculator is different for each of the four versions, 35mm imperial, 35mm metric, 16mm imperial and 16mm metric. The first two examples below relate to typical calculations using scales on the front of the Calculator on two specific versions, the other calculations are all done by using scales on the back of any version of the Calculator.]*

### 35mm METRIC VERSION

- 1 On location you want to shoot the approach of a car without pulling focus. You are using a 25mm lens (35mm format) at a stop of F8. How do you find the best focus point?

*Find the 25mm lens focal length mark on the front of the Calculator, to the left of this are the F stop markings for far distances, align F8 with infinity. The distance for the best focus point can be read off against the lens mark "25", which is 2.16 metres. To the right of the lens mark*

*the nearest point in acceptable focus is given against the other F8 mark, 1.1 metres approximately.*

### 16mm IMPERIAL VERSION

- 2 You are told by the director that anything can happen in the next few minutes. You know the stop is F8, what focus setting will give you the maximum depth of field?

*Find the 16mm lens scale on the Calculator. To the left of the focal length mark find the F8 mark and align it with infinity. The focal length mark "16" is now opposite the hyperfocal distance (8'3") and the near distance F stop mark F8 is opposite 4'2". This is the maximum depth of field for a 16mm lens at F8. The focus extends from 4' 2" to infinity (i.e. from  $\frac{1}{2}$  hyperfocal distance to  $\infty$ ).*

### ALL VERSIONS

- 3 The key light is 200 footcandles at T4. The cameraman wants to increase the stop to T8. What is the new key?

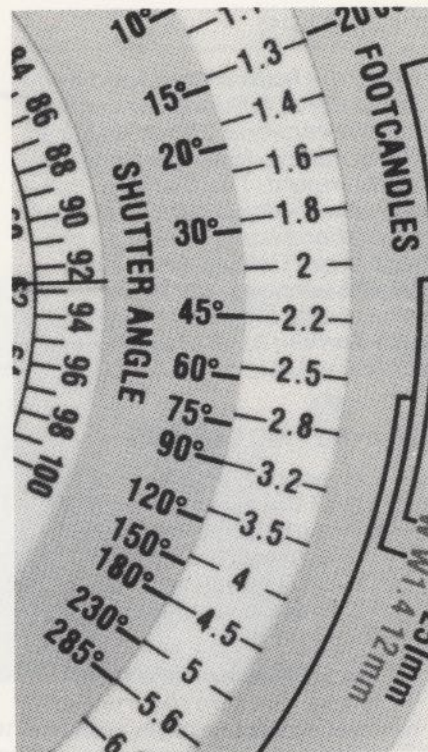
Align 200 on the footcandle scale to "4" on the T stop scale. Read off opposite T8 the new key light of 800 footcandles.

- 4 With a shutter angle opening of 180° the key light is 125 footcandles. The next shot is to be made with a shutter angle opening of 45°. What is the new key?

Align "125" on the footcandle scale with "180" on the shutter angle scale. Opposite the new angle of 45° read off the new key light of 500 footcandles.

- 5 A special effects camera is marked as having a shutter angle opening of 285°. On another camera with a shutter angle opening of 180° the T stop is T4.5. What is the equivalent stop with the special effects camera? (See illustration.)

Align "180" on the shutter angle scale with "4.5" on the T stop scale. Read off against 285° the new stop of T5.6.



(Example 5.)

- 6 After shooting a shot at T4 the director wants to do a slow motion shot. The widest aperture on the lens is T1.4. What camera speed can be used?

*Align "T4" on the aperture scale with "24FPS" on the camera speed scale, then read off against T1.4 the camera speed of 192FPS.*

- 7 It is a bright sunny day in the desert, your light meter, set at the daylight speed, with 85 filter, of 64ASA indicates an exposure of T.22. What filter will give you the required colour conversion, and a sensible T stop?

*Align 85/85b on scale to 22 on T stop scale. Read off various filter T stop combinations. For example, you can see that with an 85B ND 0.9 filter a stop of T8 is suitable.*

- 8 At rushes a tracking shot is seen to strobe, it was shot with a shutter angle opening of 20°. What neutral density filter could be used to compensate for a shutter

angle of 170° to re-shoot the scene?

*Align "No Filter" on the neutral density filter scale with "20°" on the shutter angle scale, then read off opposite 170°. An ND filter of 0.9 would suffice.*

- 9 On a foreign location your neutral density filters are still stuck in customs. You have just shot a scene at 24FPS with a shutter angle of 180°. You now need to shoot a shot at 4FPS. What shutter angle opening can you use so that you do not have to alter the lighting or the stop?

*Align "24" on the camera speed scale with "180°" on the shutter angle scale. Read off opposite 4FPS the new shutter angle of 30°.*

- 10 The scene is supposed to be shot in slow motion but with a zoom lens, 100ASA stock and the amount of lighting available you can only shoot at 40FPS. Luckily someone produces a can of stock which can be rated at 28DIN. What camera speed can you



shoot at now?

*Align 100ASA, which is 21DIN with "40" on the camera speed scale. Read off the camera speed aligned with "28" on the DIN scale which gives 192FPS.*

- 11 You have been shooting a static scene with 250ASA stock which has just run out, at a shutter angle opening of 45°. The stock you have to use now is rated at 64ASA. You do not want to alter the stop or introduce filters. What new shutter angle can compensate?

*Align "250" on the ASA/DIN scale with "45" on the shutter angle scale. Against 64ASA read off the new shutter opening of 180°.*

- 12 What neutral density filter

must be used on a camera with 200ASA/24DIN stock to be shot at the same stop as a camera with 50ASA/18DIN stock?

*Align "No Filter" on the filter scale with "50/18" on the ASA/DIN scale and read off against 200ASA/24DIN a ND filter of 0.6.*

- 13 With 5247 filmstock of 125ASA the key light is 32 footcandles. What will be the new key with 5294 filmstock of 400ASA? What will be the key if the stock is force developed and rated at 500ASA?

*Align "32" on the footcandle scale with "125" on the ASA scale. Read off the footcandle values against 400ASA and 500ASA (10 footcandles and 8 footcandles).*

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